

**REMARKS/ARGUMENTS**

The specification has been conformed to correspond to the preferred format for U.S. patent applications as required in the Office Action, and a Substitute Specification and Comparison Copy are submitted herewith.

The title of the application has been changed as suggested in the Office Action.

The Office Action noted that a certified copy of the priority application has not been filed.

Applicants did file a certified copy of German application No. 100 33 077.0, as is confirmed on the return postcard (copy attached) with which this application was filed. Also attached is a copy of the cover sheet of the certified copy of the German priority application. In view thereof, applicants request that the receipt of the priority document be confirmed.

Claims 1-12 are presently pending in this application. Claim 13 has been canceled.

The claims were objected to for a number of minor informalities as discussed in paragraph 6 of the Office Action. The proposed changes were made. In addition, applicants have deleted all reference numerals from the claims. The changes to the claims are of a purely formal nature for purposes of clarification and grammatically improving the wording of the claims, unrelated to patentability concerns.

All claims were rejected for anticipation by Pronovost (3,746,863). With respect to claim 1, the rejection was supported by the observation that Pronovost discloses "light guides (which connect the transmitters to the receivers, respectively; e.g. 20, 27, 28; see Fig. 3) provided for the transmission of the synchronization signal (see Figs. 1-3; col. 3, lines 9-11)".

With respect to independent claim 6, the rejection was supported amongst others by the observation that "the synchronization signal is transmitted during operation from the transmitter unit to the receiver unit via changing pairs of light transmitters and light receivers associated with one another".

With respect to independent claim 12, the rejection was supported amongst others by the observation that “a control unit [18] (see Fig. 3) is provided for the transmission of the synchronization signal from the transmitter unit to the receiver unit via changing pairs of light transmitters and light receivers associated with one another”.

Claim 1 of this application is directed to a light grid for detecting objects in a monitoring region that has a transmitter unit with a plurality of light transmitters and a receiver unit with a plurality of light receivers. Respective pairs of light transmitters and light receivers are associated with one another, and they bound the monitoring region. They are successively activated in dependence on a synchronization signal that is transmitted between the transmitter unit and the receiver unit. Claim 1 further requires “that at least one light guide is provided for the transmission of the synchronization signal”.

As a result, the transmissions of the monitoring signal in the monitoring region and their synchronization are uncoupled. Thus, the presence of an object in the monitoring region does not affect the synchronization procedure.

Independent claims 6 and 12 closely resemble claim 1 except that the synchronization signal is transmitted from the transmitter unit to the receiver unit via changing pairs of light transmitters and associated light receivers instead of with a separate light guide. Transmitting the synchronization signal over different pairs of transmitters/receivers ensures a secure and reliable synchronization even when an object is located in the monitoring region, because a transmitter/receiver pair and the light transmission path between them will quickly select a transmitter/receiver pair which is not interrupted by the object. As a result, there will be, at most, only a short, momentary loss of the synchronization signal between when a light beam is first interrupted by an object and when another transmitter/receiver pair that is not interrupted by the object is selected for the transmission of the synchronization signal.

Thus, a principal advantage attained by the present invention is to provide reliable synchronization by uncoupling the synchronization procedure from the monitoring signal so that an object in the monitoring region does not affect the synchronization procedure. This is ensured

by either the light guide recited in independent claim 1 or the changing pairs of light transmitters used for the transmission of the synchronization signal recited in independent claims 6 and 12.

The Pronovost patent discloses a light curtain which is generated by alternating light transmitters and receivers arranged in spaced-apart columns located on either side of the monitored region. Thus, each of the two columns has alternating transmitters and receivers. A light beam from one transmitter of the first column is received by an associated receiver in the second column. This in turn causes the next adjacent transmitter in the second column to direct a beam of light to the next receiver on the first column. This process repeats itself until the end of the column has been reached. No synchronization signal is ever generated or used. Instead, Pronovost operates as follows:

The general operation comprises the transmitter 14a in column 10 flashing a light beam across to its opposing receiver 16b which in turn signals the next highest light transmitter 14b to return a light beam back to receiver 14a in column 10 and so on back and forth until the even columns have finished transmitting and receiving their beams, at which point a switching mechanism repeats the transmission of light between the odd numbered transmitters and receivers, then recycles back to the even numbered transmitters and receivers and so forth. (column 3, lines 37-47)

The reason for this arrangement is explained as follows in the Pronovost patent:

With this arrangement, the beam of light may be relatively wide and non-sharply focused since it may shine upon not only a particular receiver expecting it but also the adjacent receiver and transmitters above and below it without affecting operation. For example, by spacing the transmitters and receivers on 1 inch centers, a beam of light of approximately 5 inches in height, centered upon the receiving receiver will not adversely affect operation. This means that the alignment of the receivers and transmitters are not critical and there is room for considerable misalignment. (column 2, lines 20-33)

This has nothing to do with synchronizing the monitoring beams. As a result, Pronovost is not concerned with synchronization and effectively contains no disclosure relating to synchronization.

Although the Pronovost patent mentions “a curtain of light formed of numerous, intermittent, synchronously operated flashes of light beams” (column 1, lines 46-47) and states that “a ‘curtain’ of light 12 formed of synchronized, momentary flashes of light beams travelling back and forth between the two towers or columns” is generated (column 3, lines 9-11), Pronovost does not further discuss what is meant by synchronization of the light beams travelling back and forth or how synchronization is attained. The only synchronization in the Pronovost patent is the sequential activation of the transmitter/receiver pairs triggered by the receipt of a light beam by the preceding receiver.

With the blockage of the light beam by an object, the system shuts down until it is reactivated. In this context, Pronovost states:

Upon interruption of any portion of the curtain, that is, the blockage of any of the beams, such as by inserting a physical object into the space, the failure of receipt of light by the particular receivers then involved, results in triggering a suitable switch.  
(column 2, lines 1-5)

This is confirmed in the description of the control circuit which is part of the light curtain disclosed in the Pronovost patent. On lines 5-7 of column 7, Pronovost states in this regard:

As a result of this arrangement, failure of any part of the system will cause a shut down of the system ....

Thus, the Pronovost patent operates along the lines of prior art systems described in paragraph 0003 of the Substitute Specification, which states in part:

... it is usual in light grids in accordance with the state of the art to emit a synchronization signal coupled to a first monitoring signal, for example from the first light transmitter of the transmitter unit, in the direction of the first light receiver of the receiver unit in order to activate it. Subsequent to this synchronization procedure, all further pairs of light transmitters and light receivers associated with one another are then activated in succession according to a given timetable in order to thus realize the desired monitoring function. The disadvantage of this procedure is that whenever the

synchronization signal is interrupted, for example, by a work piece moving into the monitoring region, no synchronization can take place between the transmitter unit and the receiver unit and thus the operation of the light grid is interrupted. It is therefore customary practice to deactivate light grids for, for example, the time of the moving in and out of an object, whereby disadvantageously no protection against non-permitted intrusion exists in this time.

The present application further explains how this disadvantage encountered with prior art light grids is overcome. Paragraph 0006 of the Substitute Specification states in part:

... the synchronization procedure is fully uncoupled from the transmission of the monitoring signal in the monitoring region and thus a synchronization takes place between the transmitter unit and the receiver unit which is independent of the light transmission path between the transmitter unit and the receiver unit in the monitoring region. The light guide in accordance with the invention provided separately for the transmission of the synchronization signal ensures that a reliable synchronization of the receiver unit takes place in dependence on the transmitter unit irrespective of a feed of an object into the monitoring region and irrespective of its position and movement within the monitoring region.

The same advantage as attained with the light guide is attained by transmitting the synchronization signal from the transmitter unit to the receiver unit "via changing pairs of light transmitters and light receivers", as is recited in independent claims 6 and 12.

Thus, while the present invention, as defined by independent claims 1, 6 and 12, assures that synchronization of the monitoring signals continues, if an object is fed into the monitoring region, the blockage of any of the beams by an object in the Pronovost light curtain "results in triggering a suitable switch" (column 2, line 5).

As the foregoing discussion demonstrates, in Pronovost the two sets of transmitters/receivers are sequentially activated, one after the other, and each transmitter is activated in response to the receipt of a light beam by the preceding receiver. If the light beam is interrupted at any location by any object, the system will shut down. If no light beam is received

by the preceding receiver due to the blockage of the light beam by an object, none of the following transmitters will be activated and the grid remains shut down.

In contrast to Pronovost, by providing a separate light guide, or by transmitting the synchronization signal via changing pairs of transmitters/receivers, synchronization is not lost when an object enters the monitoring region, and the light grid will continue to operate. As a result, the present invention, as defined by independent claims 1, 4 and 6, provides reliable protection against the intrusion of non-permitted objects into the monitoring region without requiring that the light grid, or parts of it, be switched off when a permitted object enters the monitoring zone, as is summarized in paragraph 0007 of the Substitute Specification.

Thus, Pronovost does not disclose “at least one light guide ... for the transmission of the synchronization signal” as required by independent claim 1, or transmitting “the synchronization signal ... during operation from the transmitter unit to the receiver unit via changing pairs of light transmitters and light receivers associated with one another”, as recited in independent claims 6 and 12. For this reason alone, claims 1, 6 and 12 are not anticipated by Pronovost.

Additionally, Pronovost does not disclose to use a “synchronization signal”, as is recited in the independent claims, which is separate and independent of and in addition to the monitoring signals (light beams). For this additional reason, the independent claims are not anticipated by Pronovost.

The dependent claims 2-5 and 7-11 are directed to features of the present invention not disclosed by Pronovost. These claims are therefore also not anticipated by Pronovost, and they are allowable in their own right. They are further allowable because they depend from allowable parent claims.

Thus, all claims 1-12 are patentable over Pronovost.

Application No. 09/900,000  
Amendment dated June 30, 2004  
Reply to Office Action of March 1, 2004

PATENT

**CONCLUSION**

In view of the foregoing, applicants submit that this application is in condition for allowance, and a formal notification at an early date is requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



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